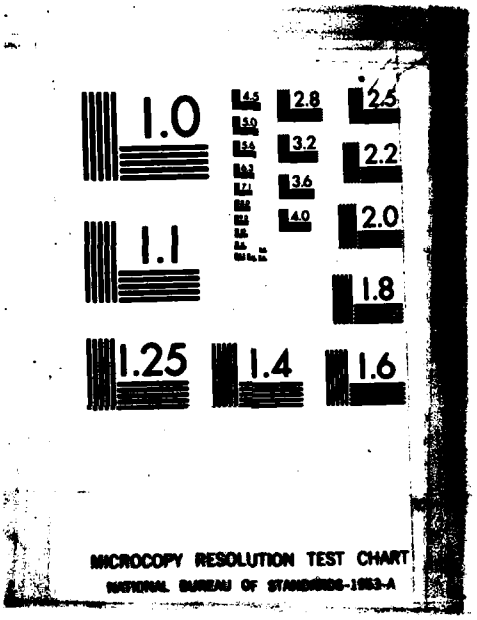
AD-A137 642 ANNUAL LETTER REPORT FOR ONR (OFFICE OF NAVAL RESEARCH) 1/1
CONTRACT N00014-82-K-0183(U) IOWA UNIV IOWA CITY
R R ANDERSON 24 JAN 84 N00014-82-K-0183

UNCLASSIFIED F/G 9/2 NL


1.0
1.1
1.25
1.4
1.6
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.8
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

(12)

University of Iowa
Iowa City, IA 52242

Annual Letter Report for ONR Contract N00014-82-K-0183
Covering the Time Period 1 December 1982 to 30 November 1983

The primary purposes of the Active Magnetospheric Particle Tracer Explorers (AMPTE) program are (1) to carry out the release and monitoring of lithium and barium ions in the solar wind and within the distant magnetosphere in order to study the access of solar wind ions to the magnetosphere, the convective-diffusive transport and energization of magnetospheric particles, and the instabilities and wave-particle interactions associated with the release and the subsequent evolution of the injected clouds, and (2) to generate a single massive release of barium in the dawn magnetosheath which will create a visible artificial comet in the flowing solar wind plasma within which studies of diamagnetic effects, ionization, momentum exchange, ion transport, and visible phenomena will be made. A complete description of the program is included in the November 9, 1982 volume of EOS, transactions of the American Geophysical Union, Vol. 63, No. 45, pages 843-850. Three spacecraft are involved in the program, a Charge Composition Explorer (CCE), an Ion Release Module (IRM) and the United Kingdom Subsatellite (UKS). The AMPTE program is a collaborative effort involving the United States, the Federal Republic of Germany, and the United Kingdom.

Gerhard Haerendel, of the Max-Planck-Institut fur Extraterrestrische Physik (MPE) in Garching, West Germany, principal investigator for the IRM, invited D. A. Gurnett and R. R. Anderson from the University of Iowa to be co-investigators on the IRM plasma wave team. A proposal for the

University of Iowa participation in the AMPTE project was submitted to the Office of Naval Research and subsequently funded under contract N00014-82-K-0183.

A block diagram of the University of Iowa AMPTE IRM Plasma Wave experiment is shown in Figure 1. The University of Iowa has provided all of the hardware indicated in the block diagram with the exception of the Fairchild Antenna which was purchased by MPE. The hardware provided include a spare HELIOS plasma wave electric field experiment, a high frequency receiver, a wideband receiver, electric field preamplifiers, antenna control electronics, and a power supply. A summary of our effort over the past year in preparing these units for the AMPTE project follows.

HELIOS INSTRUMENT

The spare HELIOS plasma wave electric field instrument was disassembled in order to find the cause of the intermittent problem discussed in the last annual letter report. A number of fractured solder bonds were found in the instrument. These fractures were caused by hardening of a Hysol compound that was used for sealing electronic circuitry when the instrument was fabricated ten years ago. Several cycles of inspecting for fractured solder joints, repairing the joints, temperature cycling, and re-inspecting the joints were carried out to make the unit flight worthy. A final workmanship vibration test and temperature test were performed at the University of Iowa prior to final delivery to the spacecraft. To provide more radiation protection in flight, a 40 mil aluminum cover was built and installed over the existing cover on the HELIOS unit.

HFR-WBR INSTRUMENT

The high frequency receiver (HFR), wideband receiver (WBR), and power supply comprise a second separate unit known as the HFR-WBR instrument. Most of the effort this past year has been spent on the construction, fabrication, and testing of this unit. The fabrication drawing for the housing was completed and the housing was machined and gold plated. The flight harness was completed and installed in the box. Fabrication was completed on all of the flight modules. The flight mother boards were built, tested, and then integrated into the flight housing. After the entire unit was assembled and bench tested, temperature and vibration tests were performed on the unit.

ELECTRIC FIELD PREAMPLIFIER

The flight HFR preamps were built, tested, and installed in the preamplifier housing. The preamplifier assembly was sent to Aerospace for rework on their preamps. After the preamplifier assembly was returned to Iowa, temperature and vibrational tests were conducted on the unit. To provide more radiation protection in flight, a 40 mil aluminum cover was built and installed over the existing cover on the preamplifier assembly.

INTEGRATION, TESTING, AND CALIBRATION

After construction of the HFR-WBR instrument, construction of the HFR preamps, rework on the HELIOS unit, and the completion of the preamplifier assembly, all of the units were integrated, tested, and calibrated at the University of Iowa prior to flight integration in West Germany. In July,

1983, an end-to-end telemetry test of the AMPTE IRM spacecraft was conducted at Jet Propulsion Laboratory, Pasadena, California. Operation and testing of the University of Iowa AMPTE IRM plasma wave wideband analog telemetry system were included in this test. As a result of the test it was determined that the wideband clipping levels were too large and the wideband receiver was subsequently modified to decrease the clipping levels to acceptable values.

In October 1983 University of Iowa personnel delivered the HELIOS, HFR-WBR, and Electric Field Preamplifier assembly to the MPE for pre-integration and system testing with the remainder of the AMPTE IRM plasma wave experiments. Bench testing of the University of Iowa plasma wave experiment units, the Aerospace plasma wave experiment units, and the MPE search coil experiment was successfully carried out. However, the MPE multiplexer and spacecraft interface units could not be made to function properly. It was also found that the spacecraft power switching units did not operate correctly. Tests were performed with the flight spacecraft telemetry system to verify that the WBR modifications discussed above did indeed reduce the clipping amplitudes to acceptable levels. In addition it was verified that both spacecraft transmitters had the correct Modulation Index and that the intermodulation components that appeared in the wideband spectrum were at acceptable levels. Similar testing earlier at JPL was inconclusive because the spacecraft transmitters had not been properly adjusted.

University of Iowa personnel returned to MPE in November 1983 to resume testing of the joint University of Iowa-Aerospace-MPE plasma wave experiment and to complete the spacecraft integration. A number of

problems in the spacecraft hardware were discovered and subsequently corrected during the testing. These included intermittent shorted wires in the harness and bad chips in the multiplexer and interface units. Numerous software problems in the programming of the microprocessor were also identified and corrected. A successful full extension test of the electric field antenna was carried out. The newly designed spacecraft power switches were also successfully tested. An abbreviated temperature test of the entire plasma wave experiment was also conducted. All parts of the University of Iowa plasma wave experiment operated correctly. However, another chip failed in the MPE multiplexer and the temperature test could not be completed. Test prodedures were prepared to enable the MPE personnel to continue the testing after the University of Iowa personnel had returned to Iowa.

The latest schedule from MPE for AMPTE IRM spacecraft testing shows that solar simulation will be from 13 February 1984 to 2 March 1984, Vibration will be from 5 March 1984 to 16 March 1984, EMC will be from 19 March 1984 to 6 April 1984, and Magnetometer calibration will be from 6 April 1984 to 29 April 1984. Prelaunch testing at Cape Canaveral will occur in June 1984 and launch is scheduled for August 12, 1984. University of Iowa personnel are presently scheduled to support the EMC testing at MPE and the prelaunch checkout at Cape Canaveral.

In preparation for post launch activities, University of Iowa personnel have participated in the planning for post launch operations, releases, data displays, data exchange, and data analysis. Currently a calibration document for all of the University of Iowa AMPTE IRM plasma wave instrumentation is being prepared. Post launch operations, release

activities, and data analysis will require support from a data analysis contract proposal that will be submitted to the Office of Naval Research within a few months.

Submitted by:

Roger R Anderson

Roger R. Anderson
January 24, 1984

C-681-427

UNIVERSITY OF IOWA AMPTE IRM PLASMA WAVE EXPERIMENT

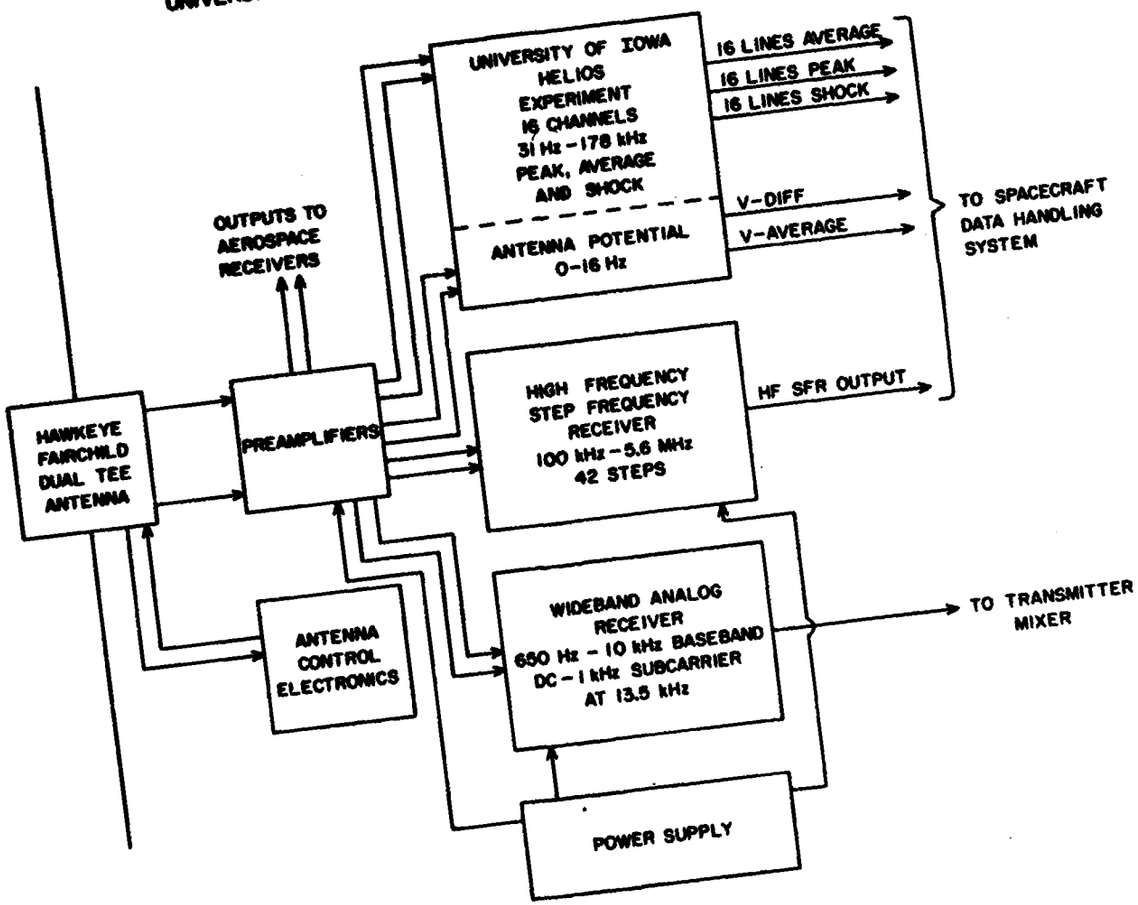


Figure 1

END

FILMED

3-84

DTIC